

District Police.]
Municipal Servants]
Boiler Inspection.]

Appointing a District Superintendent of Police for Aden.

Notn. No. 1192, dated 29th February 1892, B. G. G., 1892, Pt. I, p. 130.—His Excellency the Governor in Council is pleased to appoint as District Superintendent of Police, Aden, such of the Political Resident's Assistants as the Political Resident from time to time places in charge of the Police.

Orders under Bombay Act V of 1890.

(Municipal Servants.)

Extending the Act to the Municipal District of Karáchi.

Notn. No. 3889, dated 17th September 1895, B. G. G., 1895, Pt. IA, p. 139.—In exercise of the power conferred by sub-section (3) of Section 1 of the Bombay Municipal Servants Act, His Excellency the Governor in Council is pleased to extend, on and from the 1st December 1895, to the Municipal district of Karáchi the provisions of the said Act so far as they relate to persons employed by or on behalf of the Municipality of Karáchi to perform any of the duties specified (a) in Class I of the schedule to the said Act; and (b) in clause (c) of Class II of the said schedule.

Extending the Act to the Municipal District of Broach.

Notn. No. 1738, dated 30th March 1897, B. G. G., 1897, Pt. I, p. 604.—In exercise of the power conferred by sub-section (3) of Section 1 of the Municipal Servants Act, His Excellency the Governor in Council is pleased to extend, on and from the 1st June 1897, to the Municipal district of Broach the provisions of the said Act so far as they relate to persons employed by or on behalf of the Municipality of Broach to perform any of the duties specified in Class I of the schedule to the said Act.

Rules and Orders under Bombay Act II of 1891.

(Boiler Inspection.)

Extending Bombay Act V of 1873 to the Settlement of Aden.

⁽¹⁾ *Notn. No. 2012, dated 14th July 1880, B. G. G., 1880, Pt. I, p. 637.*—Under Section (2) of the Steam Boiler Inspection Act, Bombay Act V of 1873,

⁽¹⁾ This Notification, issued under Bombay Act V of 1873, is kept in force by Bombay Acts III of 1887 and II of 1891, Section 1.

His Excellency the Right Honourable the Governor in Council is pleased to notify for general information that the provisions of the said Act shall apply to the Settlement of Aden.

Extending Bombay Act V of 1873 to the towns of Karáchi and Kotri in Sind.

(1) *Notn. No. 2020, dated 31st May 1882, B. G. G., 1882, Pt. I, p. 394.*—Under Section (2) of the Steam Boiler Inspection Act, Bombay Act V of 1873, and in modification of the orders contained in Government Notification dated 17th April 1877, His Excellency the Right Honourable the Governor in Council is pleased to notify for general information that the provisions of the said Act shall again apply to the towns of Karáchi and Kotri in Sind.

Extending Bombay Act III of 1887 to all places within certain Districts in which it was not already in force.

• Bombay
Act III of
1887.

(2) *Notn. No. 2070, dated 28th May 1889, B. G. G., 1889, Pt. I, p. 492.*—Under Section 1, clause 2, of the Bombay Boiler Inspection Act, 1887*, His Excellency the Governor in Council is pleased to notify the extension of the said Act to all places in which the said Act has not hitherto been in force within the undermentioned districts in the Presidency of Bombay, that is to say :—

(In the Northern Division.)

The Districts of—

- (1) Ahmedabad,
- (2) Broach,
- (3) Surat,
- (4) Kaira, and
- (5) Thána.

(In the Central Division.)

The Districts of—

- (1) Ahmednagar,
- (2) Khándesh,
- (3) Násik,
- (4) Poona, and
- (5) Sholápúr.

(In the Southern Division.)

The Districts of—

- (1) Dhárwár,
- (2) Ratnágiri,
- (3) Kánara, and
- (4) Bijápúr.

(1) See footnote (1) on page 725, *supra*.

(2) This Notification, issued under Bombay Act III of 1887, is kept in force by Bombay Act II of 1891, Section 1.

*Extending Bombay Act III of 1887 to the Districts of
Belgaum and Kolába.*

(¹) *Notn. No. 903, dated 10th March 1891, B. G. G., 1891, Pt. I, p. 232.*—
Under Section 1, clause 2, of the Bombay Boiler Inspection Act III of 1887,
His Excellency the Governor in Council is pleased to notify the extension of the
said Act to the districts of Belgaum and Kolába in the Southern Division of
the Presidency of Bombay.

Extending Bombay Act II of 1891 to the District of Hyderabad in Sind.

Notn. No. 507, dated 16th February 1892, B. G. G., 1892, Pt. I, p. 119.—
Under the provisions of para. 1, clause 2, of Bombay Act II of 1891, the Gov-
ernor in Council is pleased to extend the Bombay Boiler Inspection Act of 1891
to the district of Hyderabad in Sind.

Extending the Act to the District of Shikárpur.

Notn. No. 928, dated 25th February 1896, B. G. G., 1896, Pt. I, p. 213.—
Under the provisions of sub-section 2 of Section 1 of the Bombay Boiler In-
spection Act, 1891, the Governor in Council is pleased to extend the said Act
to the district of Shikárpur in Sind.

Extending the Act to the District of Thar and Párkár.

Notn. No. 4368, dated 22nd October 1895, B. G. G., 1895, Pt. I, p. 1060.—
Under the provisions of sub-section 2 of Section 1 of the Bombay Boiler In-
spection Act, 1891, the Governor in Council is pleased to extend the said Act to
the district of Thar and Parkar in Sind.

(1) See footnote (2) on page 726, *supra*.

Extending the Act to the District of Sátára.

Notn. No. 1755, dated 31st March 1897, B. G. G., 1897, Pt. I, p. 607.—Under the provisions of Section 1 (2) (a) of the Bombay Boiler Inspection Act, 1891, the Governor in Council is pleased to extend the said Act to the district of Sátára.

The Bombay Boiler Inspection Rules, 1894.

Notn. No. 1877, dated 21st May 1894, B. G. G. 1894, Pt. I, p. 457.—In exercise of the power conferred by Sections 4, 7 and 35 of the Bombay Boiler Inspection Act, 1891, and in supersession of any rules heretofore in force under the said Act, the Governor in Council is pleased to frame the following rules for every part of the Presidency in which the said Act is in force, including Aden, viz.:—

Preliminary.

Short title.

1. These rules may be cited as the Bombay Boiler Inspection Rules, 1894.

Definitions.

2. In these rules, unless there be something repugnant in the subject or context :

(a) "the Act" means the Bombay Boiler Inspection Act, 1891;

(b) "section" means a section of the said Act;

(c) "the Collector" means

(i) in the City of Bombay, the Collector of Bombay,

(ii) in the Settlement of Aden, the First Assistant Resident, and

(iii) elsewhere, the chief local officer in charge of the Revenue administration of a district;

(d) "Aden" means the Settlement of Aden;

(e) the "Presidency Proper" includes every part of the Presidency of Bombay other than Aden and the Province of Sind,

"The Presidency" includes the Province of Sind and every other part of the Presidency of Bombay except Aden, and
"Mofussil" means any part of the Presidency except the City of Bombay;

(f) "Office" means the Bombay Boiler Inspection Office, in which all records in connection with the working of the Act in the area where it is located are to be kept;

(g) "Inspection" means the inspection of boilers under the Act, and "inspection fees" mean fees leviable under Sections 8 and 17 and these rules;

(h) The terms defined in Section 3 shall be deemed to have, respectively, the same meaning as is given to them by the Act:

(i) words in the singular include the plural and *vice versa*.

Inspector.

3. (1) No Inspector shall undertake any professional work unconnected with his duties under the Act. Duties and emoluments of Inspectors.

(2) The emoluments of Inspectors shall consist—

(a) in Aden entirely of inspection fees,

(b) in the Presidency entirely of monthly salaries payable by Government.

(3) Inspection fees received in the Presidency shall be placed to the credit of Government.

4. The location and charge of the offices for the undermentioned areas shall be as follows:— Boiler Inspection Office.

Area.	Location.	Officer-in charge.
For Aden	The Residency Office.	Inspector.
For the Presidency Proper ...	The Town Custom House, Bombay.	Senior Inspector.
For Karachi District	Office of Collector.	Collector.
For Hyderabad District ...	Do.	Do.

(For addition to this Rule, see Notifications No. 4372, dated 22nd October 1895 and No. 932, dated 25th February 1896, printed at page 733, *infra*.)

5. The Senior Inspector shall ordinarily inspect in the City of Bombay. He Duties of Senior Inspector.

(a) shall, when not engaged in out-door duties,

(i) attend office during usual office hours,

(ii) act under the orders of the Collector of Bombay, and

(iii) make to the Collector of Bombay and to the Collectors of the districts in the Presidency all reports concerning the working of the Act in their respective charges;

(b) *may*,

- (i) whenever he thinks such a course necessary or desirable, make any particular inspection in any part of the Presidency, in order to supervise the work and proceedings of the Junior Inspectors ;
- (ii) authorize or direct inspection in the said city by a Junior Inspector.

Aden Inspector's duties.

6. Inspection in Aden shall be conducted by an Inspector who shall
- (a) act under the orders of the Political Resident, and
 - (b) make reports to that officer through the Collector.

Ordinary duties of Junior Inspectors.

7. (1) Inspections in the mofussil shall ordinarily be made by a Junior Inspector.

(2) All Junior Inspectors in the Presidency shall

- (a) be subordinate to the Senior Inspector,
- (b) submit every week to the Senior Inspector copies of their diaries for his information and record,
- (c) make reports to the Senior Inspector.

Duties of all Inspectors in the Presidency.

8. Every Inspector in the Presidency shall keep the following records:

(a) a diary of the work which he performs from day to day, in which he shall enter

- (i) each place visited,
- (ii) each work performed by him under the Act,
- (iii) the fees earned on account of such work,
- (iv) such additional particulars as he or his superior from time to time thinks necessary ; and

(b) in accordance with such orders as the Collector of Bombay may make requiring statements with regard to boilers liable to inspection under the Act—

- (i) an Index,
- (ii) a Register,
- (iii) Dimension sheets,
- (iv) such other statements and records as may, from time to time, be required as aforesaid.

Subordination of Inspector in the Presidency to Collectors.

9. Every Inspector in the Presidency shall act

- (a) in respect of travelling and office work, under the orders of the Collector of Bombay ;
- (b) in respect of inspections in the mofussil and any action connected therewith, under the orders of the Collector of the district in which such inspection is required or made.

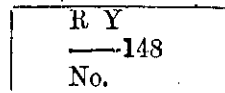
Enquiry into
misconduct,
&c., of
Engineer.

16. It shall be the duty of the Collector to enquire into any alleged drunkenness, negligence or serious misconduct on the part of any Engineer in charge of a boiler or boilers of any horse-power, and at the close of such enquiry to make such recommendation to Government with reference to Section 24 as he shall think fit.

Manner of
marking re-
gistry num-
ber on
boilers.

17. The registry number of every boiler shall be cut in the front plate thereof in such position as shall be pointed out by an Inspector. The device to be so engraved shall consist of the letters R Y above the letters No. divided by a horizontal line, the letters to be followed by the number in figures, the former to be one-half an inch and the latter one and a quarter inch in height, the whole to be enclosed in a rectangular figure one-sixteenth of an inch clear from the letters and figures.

The engraving shall be not less than one-sixty-fourth of an inch deep (*see specimen*).



Appeals and enquiries under Section 14.

18. An Appeal under Section 11 shall be made in writing, either in English or in the vernacular.

19. It may either be presented personally to the Collector or sent by post.

20. The petition of appeal shall be accompanied by the original of the reasons, given in writing by the Inspector, for the refusal of the certificate or by a certified copy of it.

21. The petition shall state the grounds of appeal against the reasons given by the Inspector for refusing the certificate.

22. On receipt of an appeal forwarded by the Collector, the Commission shall issue a notice to the appellant stating a date not later than that within which the appeal must, under section 12 of the Act, be heard, on which it is proposed to hear the appeal, and inform him that if he wishes to be heard in support of the appeal or, to produce evidence, he must be present either in person or by an authorized agent, with his evidence, on the date specified. The notice shall be sent to such address as shall be entered in the petition of appeal. If the petitioner is not present on the date fixed, the appeal shall be decided in his absence.

23. When it shall appear to the Collector that enquiry should be made with regard to any of the matters mentioned in clauses (a), (b), or (c) of sub-section (1) of Section 14, he shall inform the Commission, which shall then take action under the section. The Commission may also take action under the section of its own motion.

24. Notice shall be sent by the Commission to the person regarding whose certificate an enquiry is to be held, specifying briefly the charge made and fixing the date of the enquiry. On such date he may either submit a

10. An Inspector against whose proceedings an appeal is made shall attend every meeting of a Commission appointed under Section 5 to hear such appeal and shall make statements on such matters and submit such plans to the Commission as he thinks necessary, or as shall be called for by the Commission.

Duties of Inspectors with respect to Commissions.

11. (1) Inspections shall be carried out in accordance with the separate "Rules for settling the duties of Inspectors."

Provisions as to inspection of Boilers.

(2) If the owner or person in charge of a boiler to be examined fails to comply in any material point with any of the provisions of Section 9, the Inspector shall defer his inspection and shall report the case to the Collector, or in Bombay, if a Junior Inspector is making the inspection, to the Senior Inspector, for orders.

12. Inspecting fees shall be levied according to the following scale:—

Fees for inspection.

(1) For inspecting each boiler not exceeding... 10 N. H. P. Rs. 15

(2) For inspecting each boiler exceeding 10 but not over ... 20 " " 20

(3) For inspecting each boiler exceeding 20 but not over ... 30 " " 30

(4) For inspecting each boiler exceeding 30 but not over ... 50 " " 40

(5) For inspecting each boiler exceeding ... 50 " " 50

Commission.

13. (1) Elsewhere than in Aden, Commissions appointed by Government under Section 5 will consist of three members, one of whom shall be President of the Commission.

Commissions to consist of three members.

(2) In Aden the Commission will consist of one person appointed by Government, who shall perform the duties hereinafter imposed on the President of a Commission elsewhere.

(3) The appointments and the terms for which they are respectively to endure will be notified in the *Bombay Government Gazette*.

14. Members of Commissions shall assemble at the request of the Collector at his office or at such other place as he may specify whenever necessary for hearing appeals under Section 11 or determining questions under Section 14, or any matter relating to the Act, and a clerk of the Boiler Office or of the Collector's Office will act as clerk to the Commission.

Meeting of Commissions.

15. Every member of a Commission shall be entitled to receive in Bombay a fee of Rs. (30) thirty, and elsewhere of such amount as may from time to time be prescribed by Government for each district, for each meeting of the Commission at which any duty prescribed by the Act is performed by the Commission and which he attends from the beginning to the end thereof. In the mofussil every member of Commission shall also be entitled to travelling expenses, if any have been incurred by him.

Emoluments of members of Commissions.

written statement, or may be present in person or by authorized agent, and he shall be allowed to produce any evidence he may have bearing on the facts under enquiry.

25. The Commission may, at its discretion, summon any witness whose evidence it considers necessary for the purposes of any enquiry held by it.

26. All decisions of the Commission shall be in accordance with the votes of the majority of the members. The President shall have a casting vote.

27. The proceedings of the Commission shall be in writing and shall be signed by the President. A copy of any order passed shall be given to the person affected by it, if he apply for it, on payment of copying charges and stamp fees.

Enquiries under Section 24 (1).

28. If the Collector shall have reason to believe, from any cause whatever, that an enquiry should be made under Section 24 (1) with regard to incompetency, drunkenness, serious misconduct or negligence on the part of any Engineer possessing a certificate of competency or service under the Act, he may either make such enquiry personally or cause it to be made by an Assistant or Deputy Collector. The proceedings shall be held in the presence of the Engineer whose conduct forms the subject of the enquiry, and he shall have an opportunity of making any statement he may wish to make and of producing evidence in his defence. The Collector shall forward the proceedings, with the opinion of the officer conducting the enquiry, to Government, with such recommendation with reference to Section 24 as he shall think fit.

Notn. No. 4372, dated 22nd October 1895, B. G. G., 1895, Pt. I, p. 1060.—In exercise of the power conferred by Sections 4, 7 and 35 of the Bombay Boiler Inspection Act, 1891, the Governor in Council is pleased to direct that the rules made for the Presidency, including Aden, under the said sections, and published in Notification No. 1877, dated 21st May 1894⁽¹⁾, at pages 457—459 of the *Bombay Government Gazette* for 1894, Part I, shall be modified as follows:—

In Rule 4 of the said rules insert the following:

Area.	Location.	Officer in charge.
For Thar and Parkar District.	Office of Deputy Commissioner.	Deputy Commissioner.

Notn. No. 932, dated 25th February 1896, B. G. G., 1896, Pt. I, p. 214.—In exercise of the powers conferred by Sections 4, 7 and 35 of the Bombay Boiler Inspection Act, 1891, the Governor in Council is pleased to direct that the rules made for the Presidency, including Aden, under the said

⁽¹⁾ Printed *supra*, page 728.

sections, and published in Notification No. 1877, dated 21st May 1894⁽¹⁾, at pages 457—459 of the *Bombay Government Gazette* for 1894, Part I, shall be modified as follows :—

In Rule 4 of the said rules insert the following :

Area.	Location.	Officer in charge.
Shikárpur District.	Office of Collector of Shikárpur.	Collector.

Appointing a Board of Examiners in Bombay.

Notn. No. 1033, dated 3rd March 1896, B. G. G., 1896, Pt. I, p. 233.—In exercise of the powers conferred by Section 20 of the Bombay Boiler Inspection Act, 1891, the Governor in Council is pleased to nominate the following gentlemen to be members of the Board of Examiner in Bombay :—

Ex-officio President.

The Collector of Land Revenue, Customs and Opium, Bombay.

Members

Determining the authorities deemed competent to grant certificates of competency.

Notn. No. 602, dated 22nd February 1893, B. G. G., 1893, Pt. I, p. 194.—In exercise of the power conferred by Section 22 of the Bombay Boiler Inspection Act, 1891, His Excellency the Governor in Council is pleased to determine that the authorities hereinbelow mentioned shall be deemed competent authorities for the purpose of the said section under which any Engineer in possession of a Certificate of Competency granted by any competent authority in British India or in the United Kingdom or in any British Colony is entitled to receive a Certificate of Competency without undergoing examination, namely :—

- The Board of Trade.
- The Steam Navigation Board, Victoria.
- The Minister of Marine and Fisheries, Canada.
- The Marine Department, New Zealand.
- The Marine Board, New South Wales.
- The Head of the Government, Malta.
- The Marine Board, South Australia.

The Board of Examiners under the authority of the Governor of Tasmania.

The Calcutta Marine Board (*i.e.*, the Lieutenant-Governor, Bengal).

The Burma Boiler Act Board.

The Straits Settlement Board.

The Marine Board, Queensland.

The Governor, Hongkong.

The Bombay Marine Board (*i.e.*, the Governor of Bombay).

The Bombay Engineers' Examination Rules, 1895.

Notn. No. 515, dated 3rd February 1895; B. G. G., 1895, Pt. I, p. 94.—

The following rules framed by Government under Section 35 of the Bombay Boiler Inspection Act, 1891—

(1) for settling, under clause (a) thereof, the duties and emoluments of Examiners appointed under the said Act,

(2) for regulating, under clause (c) of the said section, the conduct of the examinations to be held under Section 19 of the said Act,

(3) for prescribing, under clause (d) of the Section 35 aforesaid, the qualifications to be required of candidates at the said examinations, the fees to be paid by them, the forms of certificates to be granted to them, and the capacity of boiler of which each such certificate shall qualify the holder to be in charge, and

(4) under clause (f) of the Section 35 aforesaid generally for giving effect to the provisions of the said Act in every part of the Presidency of Bombay in which that Act is in force, including Aden ;

are published for general information. These rules supersede all rules heretofore in force under the said Act with the exception of those published under Government Notifications Nos. 1877⁽¹⁾ and 1877A⁽²⁾, dated 21st May 1894* :—

*Published at pages 457 *et seqq.* of the *Bombay Government Gazette* for 1894, Part I.

Rules relating to Certificates and Examinations of Mechanical Engineers.

- I. Preliminary.
- II. Board of Examiners.
- III. Examinations.
- IV. Admission of candidates to the examination for Certificates of Competency—
 - A. General.
 - B. Testimonials.
 - C. Age and training of candidates.
 - D. General rules regarding service.

(1) Printed at page 728, *supra*.

(2) Printed at page 753, *infra*.

- V. Subjects of examination for Certificates of Competency.
- VI. Mode of examination.
- VII. Rules for the examination room.
- VIII. Grant of Lower Grade Certificates in certain cases.
- IX. Postponement of grant of Certificates in certain cases.
- X. Surrender of Lower Grade Certificates.
- XI. Certificates of service.
- XII. Form of Certificates.
- Appendices.

I.—Preliminary.

Short Title.

1. These rules may be cited as "The Bombay Engineers' Examination Rules, 1895."

2. In these rules unless there be something repugnant in the subject or context—

(a) "the Act" means the Bombay Boiler Inspection Act, 1891;

(b) "section" means a section of the said Act;

(c) "the Collector" (i) means in the City of Bombay the Collector of Bombay, (ii) in Aden includes the First Assistant Resident, and (iii) means elsewhere the chief local officer in charge of the revenue administration of a district;

(d) For substituted clause (d) see Notification No. 5605, dated 22nd December 1896, printed at page 751, *infra*.

(e) words in the singular include the plural, and *vice versa*.

II.—Board of Examiners.

3. The Collector shall be *ex-officio* President of the Board of Examiners.

Meetings.

4. The examiners from time to time nominated under Section 20 shall meet at the request of the Collector, whenever necessary, in such place as he may from time to time deem expedient.

Examinations
by whom to
be conducted.

5. Each examination shall be conducted by such members of the Board, not less than four in number, as the Collector with a view to their successive service as far as possible in rotation may request to attend for the purpose.

Emoluments.

6. Each Examiner shall be entitled to receive a fee of 50 rupees *per diem*⁽¹⁾ for each meeting of the Board, at which any duty prescribed by the Act is performed and which he attends from the beginning to the end.

7. The Examiners shall endorse on the printed application of each candidate the result of his examination for a certificate of competency, and return to the Collector the application so endorsed.

III.—Examinations.

Dates of
examination.

8. (i) Examinations shall ordinarily be held in the City of Bombay for the Presidency proper, and for Sind in the City of Karachi, once every two

⁽¹⁾ The words "per diem" were inserted by Notification No. 1503, dated 30th March 1896, printed at page 752, *infra*.

months on the second Wednesday of the month. (ii) at Aden examinations shall be held once every two months on the second Wednesday of the month and shall be for third class certificates only.

9. Every examination shall be attended by one or more clerks from the Collector's office, who shall do such clerical work as may be necessary and shall act as interpreter when required to do so by the Board of Examiners.

10. The examinations will be of three kinds, one for each of the three kinds of classes of certificates of competency which the Board is hereinafter empowered to grant.

IV.—Admission of Candidates to the Examinations for Certificates of Competency.

A.—General.

11. Candidates at examinations for certificates of competency will pay fees at the following rates:—

	Rs.
For a 1st class certificate	... 20
Do. 2nd do.	... 15
Do. 3rd do.	... 10

Unsuccessful candidates will not be entitled to a return of any portion of the fees paid by them; but, if applied for, the fee paid by any applicant who is not admitted to examination will be returned to him in full:

Provided that in the event of a candidate being unavoidably absent from any examination for which he has paid fees, it shall be in the discretion of the Collector to allow him to appear at any examination held within six months of the first without a second payment of fees.

12. Every applicant for examination must make an application in the form of Appendix A. He shall duly fill in all the parts of the said form which are to be filled in by a candidate, and sign the same in the presence of the Collector, an Assistant Collector or a Magistrate, who shall append his signature in token of attestation. The applicant shall then lodge his application at the office of the Collector not later than fifteen days before the date fixed for the examination, together with—

- (a) all testimonials of good character, sobriety, experience and ability, together with copies of the same;
- (b) any other papers required by these rules or the printed form of application; and
- (c) a receipt from a Government treasury for the amount of the fee prescribed in Rule 11 for the examination at which he wishes to appear;
- (d) a letter declaring in what language he desires to be examined;
- (e) all previous certificates issued to the applicant under the Act.

13. Candidates for certificates of competency who are natives of India must prove to the satisfaction of the Examiners that they can read their vernacular sufficiently well to perform the duties required of them.

B.—Testimonials.

Testimonials.

14. No applicant will be admitted to examination whose testimonials as to sobriety, experience and ability do not relate to a period of at least 12 months immediately preceding the date of application to be examined, and are not in the opinion of the Board trustworthy and satisfactory.

15. The testimonial for any period during which the candidate acted as a chief engineer must be signed by the manager, owner or secretary by or under whom the candidate was employed, and, for such period as he acted as a second or lower grade engineer, must be signed by the chief engineer, to whom the candidate was subordinate; but if for any sufficient reason the chief engineer's signature is not obtainable, it may be signed by the manager, owner or secretary, but the testimonial must declare that the facts stated therein are either in accordance with the reports of the chief engineer, or, if no such reports are available, are within the personal knowledge of the person signing the same.

16. Testimonials relating to service beyond the limits of British India must be countersigned either by the Consul, or by some other recognised official authority of the country in which the service was performed; or, in the case of a Native State, by the Political Agent:

or must be authenticated by the testimony of some credible person on the spot having personal knowledge of the facts required to be established.

17. If the Board has reason to doubt the truth of any fact stated in any application or testimonial, it may make through the Collector such inquiries as it shall think fit.

18. The applications and copies of the testimonials referred to in Rule 12 shall be filed in the office of the Steam Boiler Department, and the original testimonials shall, at the close of each examination, be returned to the candidates who presented them, if they apply for the same, and copies of them shall be obtainable free of cost on application to the Collector.

*C.—Age and Training of Candidates.*Training of
third class
candidates.

19. A candidate for a third class certificate of competency will not be admitted to examination, unless he (a) is qualified within the meaning of the rules next following as a candidate for a second class engineer's certificate of competency, or unless he (b) proves to the satisfaction of the Board that previous to his application he has been three years employed as a fireman on engines and boilers, or (c) produces from the Principal of the College of Science at Poona, or from the Principal of the Victoria Jubilee Technical Institute at Bombay, a certificate stating that he has completed a three years' course in the workshops of that College or Institute and during that period has been constantly instructed in the management of engines and boilers.

Age and
training of
second class
candidates.

20. A candidate for a second class engineer's certificate of competency must be 21 years of age. No candidate for a certificate of this class will be admitted to the examination, unless he (1) proves to the satisfaction of the Board that, previous to his application,—

(a) he has served an apprenticeship for not less than three years to an engineer, and that during that time he has been employed on the making or repairing of engines; or

(b) he has been employed for not less than three years as a journeyman mechanic in some factory or workshop on the making or repairing of engines; or

(c) he has for not less than two years fulfilled the requirements either of clause (a) or of clause (b) as to service or employment, and has, for not less than one year in addition thereto, served as engineer in charge or assistant engineer in some mill or factory with boilers under steam;

or unless he (2) produces from the Principal of the College of Science at Poona or under the signature of the Director of Public Instruction, as the full Technological Certificate of the Victoria Jubilee Technical Institute at Bombay, a certificate stating that he has completed in the workshops of such College or Institute a three years' course, and during that period has been constantly instructed in the management of boilers and engines.

21. A candidate for a first class engineer's certificate of competency must be 22 years of age. No candidate for a certificate of this class will be admitted to the examination unless he proves to the satisfaction of the Board that, previous to his application,—

Age and
training of
first class
candidates.

(1) he has received such training as is required by Rule 20 in the case of a candidate for a second class engineer's certificate of competency; and also proves that—

(2) either

(a) he possesses or is entitled to a first class engineer's certificate of service; or,

if he neither possesses nor is entitled to a first class certificate of service,

(b) that he has served—

(i) for at least one year with boilers under steam as engineer with a second class engineer's certificate of competency; or

(ii) for at least two years with boilers under steam as engineer with a second class engineer's certificate of service; or

(iii) for at least one year with boilers under steam as second engineer with a second class engineer's certificate of service, and, in addition, for at least six months as chief engineer with boilers under steam which are by law required to be in the charge of an engineer holding a certificate:

Provided that if an applicant who is able to satisfy the Collector as to the character of his services, has in consequence of service abroad been unable to obtain a second class certificate of competency or of service, he may be allowed, if the Collector see fit, to be examined for a first class certificate of competency or of service although he has not obtained a certificate of the lower grade.

22. Any person qualified under the rules hereinbefore contained to appear for examination as a candidate for a certificate of any class other than the third class, may be permitted to appear for examination as a candidate for a certificate of any class inferior to that for which he is so qualified to appear as a candidate.

D.—General Rules regarding Service.

23. Every candidate who qualifies for admission to the examination by engine-room service, must show by his testimonials that he has been regularly employed in the engine-room as a fireman or as an engineer of a certain grade.

24. Service with boilers not continuously under steam shall count as service of half the same length with boilers continuously under steam, unless the candidate proves that more than half of such service was actually under steam; and the candidate must show by his testimonials whether the boilers with which he has worked were or were not continuously under steam.

25. Service as an engineer means service in those capacities only which afford opportunities of obtaining practical experience as an engineer on engines, boilers and their appurtenances; it does not include service as a fireman, stoker, donkeyman, greaser, winchman, labourer, or engineer's steward.

26. Service performed in places where the Act is not in force may be accepted as qualifying service subject to the same rules as those which apply to service performed in places where the Act is in force.

V.—Subjects of Examination for Certificates for Competency.

Third class.

27. To be entitled to a third class certificate of competency a candidate must satisfy the Examiners that—

- (a) he fully understands the working and management of boilers, the use of the best means of firing for the prevention of smoke, and the separate use of gauge glass-cocks, blow-off cocks, scum-cocks and other appliances;
- (b) he is able to some extent to explain the actual working of engines, and the separate uses of feed-pumps, slide-valves, pistons and other appliances;
- (c) he is able to show how he would act in case of the break-down of any portion of the machinery, &c.

Second class.

28. To be entitled to a second class certificate of competency a candidate—

- (a) must give a description of boilers, and the methods of staying them, together with the use and management of the different valves, cocks, pipes and connections;
- (b) must understand how to correct defects from accident, decay and other causes, and know the means of repairing such defects;
- (c) must understand the use of the barometer, thermometer and salinometer, and the principles on which they are constructed;
- (d) must know the causes, effects and usual remedies for incrustation and corrosion;
- (e) must state how a temporary or permanent repair could be effected in case of derangement of a part of the machinery, or of total break-down;
- (f) must write a legible hand, and understand the first five rules of arithmetic, and decimals, and their application to questions about consumption of stores, full capacities of tanks, the duty of pumps, and the direct strains in engines and boilers;
- (g) must pass a creditable examination as to the various constructions of engines in general use and as to the details of the different working parts, external and internal, and the use of each part;
- (h) must possess a creditable knowledge of the prominent facts relating to combustion, heat and steam.

29. To be entitled to a first class certificate of competency a candidate First class.
must be able to—

(a) make an intelligible hand-sketch or a working drawing of some one or more of the principal parts of a steam-engine; and to mark in, without a copy, all the necessary dimensions in figures, so that the sketch or drawing could be worked from ;*

(b) take off and calculate indicator diagrams ;

(c) calculate safety-valve pressures, and the strength of the boiler shell, stays and riveting ;

(d) state the general proportions borne by the principal parts of the machinery to each other, and calculate the direct stress, the torsional stress and the bending stress, in round bars, and the direct stress and the bending stress in rectangular bars with given loads ;

(e) explain the method of testing and altering the setting of the slide-valves, and sketch about what difference any alteration in the slide-valve will make in the indicator diagram, and also explain the method of testing the fairness of shafts, and of adjusting them ;

(f) explain surface condensation, super-heating, and the working of steam expansively ;

(g) work calculations including the mensuration of superficies and solids and the extraction of the square root, and the application of these rules to questions relating to the power, duty and economy of engines and boilers, and to the stresses in rods, shafts and levers of the engine.

VI.—Mode of Examination.

30. Every examination shall be of such a nature as to test the practical knowledge of the candidates and to ascertain their competency to manage Examination to be practical.
boilers and prime-movers.

31. The examination for third class certificates will be conducted *vivâ voce*, and in the City of Bombay will be held in Her Majesty's Indian Marine Dockyard, and elsewhere, if possible, in a foundry where the candidate's knowledge can be practically tested in the use of the steam, vacuum and water-gauges. Third class.

32. (1) Each first and second class candidate will in the first place be called upon to give written answers within a prescribed time to ten of the "Elementary Questions" issued by Government and referred to in Appendix D. First and second class.
If the candidate's answers are not satisfactory, his examination will cease, and he shall be declared to have failed.

(2) If his answers to the ten questions are satisfactory, the candidate will be called upon—

(a) if a first class candidate—

(i) to answer, within a prescribed time, a paper of ten questions in arithmetic as specified in clause (g) of Rule 29 ;

(ii) to make, within a prescribed time, a rough drawing of some part of a boiler or engine ;

(iii) to answer *vivâ voce* questions on the subject specified in clauses (b) to (f), both inclusive, of Rule 29, and on the papers which may have been set to him ;

*See Appendix C.

- (b) if a second class candidate—
 - (i) to answer, within a prescribed time, a paper of ten questions in arithmetic as specified in clause (f) of Rule 28;
 - (ii) to answer *viva voce* questions on the subjects specified in clauses (a) to (g), both inclusive, of Rule 28 and on the papers which may have been set to him;
 - (3) Answers to written questions must be worked out in the presence of at least one of the Examiners.
 - (4) Each candidate's answers to written questions must be given up on the expiry of the time prescribed, whether his answers are then complete or not.
 - (5) If, at the expiry of the time prescribed—
 - (a) the answers given by the candidate satisfy the Examiners of his capability to take charge, in the case of—
 - (i) a first class candidate, of boilers, whatever their nominal horsepower, and in the case of
 - (ii) a second class candidate, of boilers of ninety nominal horsepower,
 - (b) the candidate has failed to work out the whole of the questions set to him, but the result of the *viva voce* examination, taken in connection with the answers to such of the questions as he has worked out, satisfies the Examiners that the candidate is competent to take charge, in the case of—
 - (i) a first class candidate, of boilers, whatever their nominal horsepower, and in the case of
 - (ii) a second class candidate, of boilers of ninety nominal horsepower.
- he shall be declared to have passed, otherwise the candidate shall be declared to have failed.

Re-appearance
for examina-
tion.

33. When a candidate for a first or second class certificate fails either in the elementary questions or in the subsequent portion of the examination, the Board of Examiners shall fix a period after the expiry of which he may again appear for examination, and shall inform him thereof; and the candidate shall not be at liberty to appear again for examination at any place at which an examination is held under the Act until after the expiry of the period so fixed.

VII.—Rules for the Examination Room.

34. Candidates will be allowed, in the time allotted, to cancel any part of their work, and, when required, additional paper will be supplied by the Examiner, but they will not be allowed to work out the problems on a slate or on waste paper. The additional sheets must be attached to and form part of the examination papers to be given in by the candidate.

35. The examination in rough working drawing which candidates for first class certificates have to pass under Rule 29 (a), may, at the candidate's option, be applied either to hand-sketches clearly dimensioned and complete in the necessary *views* and *sections* or to drawings to a scale. Candidates will have to bring with them any drawing instruments they may require.

36. A candidate discovered (a) to have taken into the examination room any book, paper, document or memoranda of any description, or (b) copying from or affording, giving or receiving any assistance or any information to or from, or communicating in any way with another, during the time of examination, shall be regarded as having failed in his examination, and will be turned back for four months, in the same manner as if he had failed in the practical part of the examination; and no part of the fees he may have paid for examination will be returned to him. Penalty for unfairness.

37. If a candidate leaves the room before answering any question which has been given to him, he cannot afterwards be permitted to answer it, but the Examiner may substitute other data, or another question. Leaving examination room.

VIII.—Grant of Lower Grade Certificates in certain cases.

38. If a candidate allowed under the proviso to Rule 21, to be examined for a first class certificate though he has not obtained a certificate for a lower grade, or if a candidate already in possession of a certificate of service fail to pass the examination for the higher grade, but pass the examination for the lower grade, he may receive a certificate for the grade passed, but no part of the fee paid by him will be returned. Lower grade certificates.

39. A candidate who has been permitted to be examined for a first class certificate of competency under the proviso to Rule 21 without first obtaining a second class certificate of competency or a first class certificate of service, and who fails in his examination in practical knowledge, shall not be re-examined for a certificate of the higher grade until he has served 12 months as second engineer with a second class engineer's certificate of competency as required by the rules. Consequence of failure.

40. If the candidate fails in the examination for the lower as well as for the higher grade of certificate, he may be re-examined for a second class certificate only, subject to the provisions of Rule 33.

IX.—Postponement of Grant of Certificate in certain cases.

41. (1) If, after a candidate has passed his examination, it is discovered that his services are insufficient to entitle him to a certificate of the grade for which he has passed, such certificate will not be granted to him; but, if the Collector is satisfied that the error in the calculation of his services did not occur through any fault or wilful misrepresentation on the candidate's part, the Collector may direct the certificate to be issued, or may allow the candidate to appear for re-examination without payment of further fee, when he has performed the deficient service. Short service.

(2) If, in such a case, the applicant's services are sufficient to entitle him to receive a certificate of a lower grade, provided as aforesaid he has not wilfully misrepresented the amount of his services, a certificate of such lower grade may be granted to him, and the difference between the fee paid by him for the superior certificate and the fee payable for the inferior certificate may be refunded. Service sufficient for a lower grade certificate.

(3) In such a case, when the applicant has by further service made up the time in which he was found to be short, he may be required, before he can receive the higher certificate, to be re-examined in all the subjects. Re-examination.

X.—Surrender of Lower Grade Certificates.

Holder of
lower grade
certificate to
surrender it
before grant
of first or
second grade
certificate.

42. No certificate of the first or second class shall be granted to the holder of a certificate of a lower grade unless and until the holder has surrendered to the Collector the certificate of the lower grade.

43. Every certificate of competency granted under Section 22 to a person in possession of a certificate entitling him thereto under the said section shall be in the form in this behalf provided in Appendix B, and shall be endorsed on the certificate of competency by virtue of which such person is so entitled as aforesaid.

XI—Certificates of Service.

Examinations
to be practical.

44. In order (1) to ascertain that a candidate for a certificate under Section 23 of the Act is possessed of competent skill for the charge and management of a boiler, and (2) to determine what class of certificate he is qualified to hold, the Board of Examiners shall subject him to such practical examination as they in each case think fit.

45. Applicants for certificates of service will be charged fees at the following rates :—

	Rs.
First	10
Second	5
Third	3

XII—Form of Certificates.

Form of
certificate.

46. Certificates of competency and of service shall be in the forms given in Appendix B, respectively, or to the like effect.

Certificates
under Section
22.

47. Applications under Section 22 for certificates of competency corresponding to foreign certificates in the possession of the applicants, shall be in the form of Appendix A. Each applicant shall duly fill in the form, and, together with copies of the original foreign certificates in his possession, shall lodge the form with the Collector at least ten days before any meeting of the Board of Examiners.

48. (For substituted Rule 48, see Notification No. 4221, dated 25th September 1896, printed at page 752, *infra*.)

Duplicate
certificates
now to be
made.

49. Applications for duplicates under Section 26 shall be lodged with the Collector, together with a sworn declaration describing the lost certificate and other documents relied upon by the applicant.

Record of
uplicates.

50. Duplicates of all certificates granted under the Act shall be recorded in the Steam Boiler Office.

APPENDIX A.

Bombay Boiler Act II of 1891.

APPLICATION

FOR AN

ENGINEER'S CERTIFICATE OF COMPETENCY
UNDER SECTION _____

Rotation No.



GOVERNMENT OF
BOMBAY.
ISSUED BY
ORDER OF THE GOVT.
OF BOMBAY.

(A.)—Name, &c., of Applicant.

Names at full length.	Surname.	Permanent Address, stating Town, Street and No. of House and name of Person (if any) with whom residing.	Date of Birth.			Where born.	
			Day.	Month.	Year.	Town.	Country.
1	2	3	4	5	6	7	8

(B.)—Particulars of all previous Certificates (if any) whether issued in British Possessions, or elsewhere.

Number.	Competency or Service.	Grade.	Where issued.	Date of issue.	If at any time suspended or cancelled, state by what Court or authority.	Date.	Cause.
9	10	11	12	13	14	15	16

(C.)—Certificate now required.

Grade.	Competency or Service.	Address to which it is to be sent.
17	18	19

(D).—*If Applicant has failed in a previous Examination for the Certificate now required, he must here state when and where. If he has not failed, he must state so in writing across this Division.*

Day. 20	Month. 21	Year. 22	Port. 23	Subjects in which he failed. 24

(E).—*Declaration to be made by Applicant.*

(TAKE NOTICE).—Any person who makes, procures to be made, or assists in making, any false representation for the purpose of obtaining for himself or any other person, a Certificate either of Competency or Service will be criminally prosecuted.

I DO HEREBY DECLARE that the particulars contained in Divisions (A), (B), (C), (D), and (F), of this Form are correct and true to the best of my knowledge and belief; and that the PAPERS enumerated in Division (F) and sent with this Form are true and genuine documents, given and signed by the persons whose names appear on them. I further declare that the Statement (F) contains a true and correct account of the whole of my services without exception.

And I make this Declaration conscientiously believing the same to be true.

Dated at _____ this _____ day of _____ 189 .

Signed in the presence of

Signature of applicant.

Present address.

(F).—List of Testimonials and Statement of Service.

(The Testimonials to be numbered consecutively according to the number given in Column 25 below.)

No. of Testimonial (if any).	Where employed.	Horse-power of Engines.	Style of Factory.	Service of Applicant.						Remarks.	Initials of verifier.
				Capacity.	Date of Commencement.	Date of Termination.	Time employed in this service.				
							Years.	Months.	Days.		
25	26	27	28	29	30	31	32	33	34	35	36
Total service ...											
Time served for which Certificates are now produced .											
Time served for which no certificates are produced ...											

(G).—Certificate of Examiner.

NOTE.—The Examiner should fill up Divisions (G) and (H) and in all cases as soon as possible forward this Paper to the Collector. If the applicant passes, his Testimonials and previous Certificate, if any, must be sent with this paper. The new Certificate and the Testimonials will be delivered to the applicant at the Office of the Collector.

Date and Place of Examination.		Insert passed or failed in each Column.		Rank for which passed.
Date.	Place.	In working out the Questions.	In the <i>visd voce</i> Examination.	
37	38	39	40	41

(H).—*Personal description of Applicant.*

Height.		Complexion.	Personal Marks or Peculiarities if any.	Colour of	
		44	45		
Feet. 42	Inches, 43			Hair. 46	Eyes. 47

I HEREBY CERTIFY that the particulars contained in Divisions (G) and (H) are correct.

This Form and the Testimonials are forwarded to the Collector.

This _____ day of _____ 189 .

To

THE COLLECTOR,
BOMBAY.

{ Signature of
Examiner.

APPENDIX B.

(For substituted Appendix B, see Notification No. 4221, dated 25th September 1896, printed at page 752, *infra*.)

APPENDIX C.

Examination in Rough Working Drawing for a First-Class Engineer's Certificate of Competency.

1. The regulations in regard to the qualifications of a candidate for a First Class Engineer's Certificate of Competency specify that—

“He must be able to make rough working drawings of the different parts of the engines and boilers ;

“He must be able to state the general proportions borne by the principal parts of the machinery to each other.”

2. In accordance with these clauses a candidate for a first-class certificate is required to make a rough working drawing of the parts specified on the other side of this leaf. A mechanic who has been some years in charge of engines and boilers ought by this time to have familiarly in his mind the general construction of at least one set of engines and boilers, say that set he was last with. Fine drawing is not expected, and in the proportions of the parts a wide margin will be allowed; absurd dimensions will be failure in practical knowledge.

3. The drawing must, however, be practically a working drawing, giving a sufficient number of views to show the parts fully—sections, plans, or elevations, just as the candidate would require to be supplied to him if he had to make the parts to the design of another person.

4. A clear hand sketch showing the construction completely and fully dimensioned, will be accepted if the candidate prefers this alternative.

5. A portion only of the parts specified may be accepted in place of the whole, if that portion is sufficient to show that the candidate has a good practical idea of the construction of the parts, and a fair notion of their general proportions or dimensions.

6. Candidates are hereby cautioned not to put on paper what they have not fully considered and deliberately intend to be understood as their statement of what they know about the construction of any part required.

7. The statements given in by a candidate may be in themselves, apparently, of little importance, but, as sample material from which the state of the candidate's knowledge of engines and boilers is to be inferred, every detail which is glaringly inconsistent with a sound knowledge of the use of the part, or in which an essential consideration has evidently been overlooked, is an important element in the description which the candidate is giving of his own qualifications.

8. The candidate is advised not to begin more than he can clearly finish in the time allowed. An important object in this part of the examination is to ascertain whether the candidate can be trusted to mark all necessary dimensions upon a sketch or a drawing. The test of this is, practically, the making of the part from the sketch without having to supply additional dimensions, and without measuring the drawing. To prove this ability the candidate must fully dimension the parts shown in his sketch or drawing notwithstanding that the parts may be correctly drawn to scale. A drawing is fully dimensioned when no part of it is left to the option of the party who is to work to the drawing.

9. To prevent misunderstanding, however, when the candidate has been led into showing more of the details than he has time fully to finish, he should name, in the statement on the other side, the particular parts which he has fully dimensioned.

10. All dimensions should have lines and darts to indicate distinctly the points between which the dimensions are given.

11. Beware of writing cross dimensions upon centre lines or upon longitudinal dimension lines. This is not an order but a recommendation.

12. The candidate is not expected to design anything: he has merely to sketch or draw something with which he is expected to be already familiar.

13. Pencil in nothing after 3 o'clock: all the dimensions, the figures, and the darts must be inked in; employ the remaining time in examining the drawing and in inking in any figures which may have been before overlooked, and in checking the dimensions.

14. Make sure that you will have sufficient room on the sheet to show all the necessary views. You can have another sheet of paper if necessary. All the paper used must be forwarded with the drawing.

15. Fill in and sign the following statement:—

SUBJECT FOR EXAMINATION IN ROUGH WORKING DRAWING.

(Read the foregoing General Instructions.)

A common slide valve with its spindle. Show also an outline section of the parts at the cylinder face. Show the provision for connecting the slide valve to the spindle.

The candidate is requested to fill up the following and to attach this paper to his drawing:—

STATEMENT BY THE CANDIDATE.

The accompanying drawing, made by me this day, without referring to any document, and without the assistance of any person, is intended by me to be sufficient for the new construction of the parts above described, to fit the places of similar parts which are to be removed. The construction is similar to what I have been with in the _____ Factory, Mill, or Workshops _____, but the dimensions may be different.

The diameter of the cylinder is _____

The stroke of the piston is _____

The stroke of the valve is _____

The cover at top end on steam side is _____

The cover at bottom end on steam side is _____

The lead at top is intended to be _____

The lead at bottom is intended to be _____

The inside cover is + _____ or _____

The thickness of the face of valve is _____

The thickness of the body of valve is _____

The greatest opening for steam will be _____

That gives an area equal to one _____

The opening for exhaust when the crank is on the top centre is _____

That gives an area equal to _____ th of piston.

The length of the connecting rod is _____

The valve will cut off steam on the down stroke at _____

The valve will cut off steam on the up stroke at _____

*The candidate may omit
this part if he chooses.*

The parts fully dimensioned, in ink, are _____

Dated at _____
this _____ *day of* _____ 189 .

Applicant.

APPENDIX D.

Instructions to Engineer Examiners.

Examiners will require all candidates to fill up a form of which a copy is attached, and they will forward the same to the Collector along with the report of the examination.

For the present the questions for both classes of engineers will be taken from the same book of "Elementary Questions"; and candidates for first class certificates are expected to show their superiority by giving answers more complete than those of the other candidates.

The arithmetical questions for engineers and the *visd voce* examinations for all candidates will be continued as heretofore, and failure in the elementary questions will be treated as failure in arithmetic.

The numbers of the questions for each examination are not to be communicated to the candidate until his examination commences.

New editions with alterations will be issued from time to time.

For the questions to be answered, see the Book of Elementary Questions. The questions need not be written, only the answers to them.

*Form of Preliminary Questions to be answered by the First
Class and Second Class Candidates.*

City	Class for which examined
Date	Candidate's name

- a. Where and how long did you serve in works at the making or at the repairing of engines, and in what capacities?
- b. How long have you served as fireman or driver?
- c. How long have you served in the engine-room and in what capacities?
- d. With what descriptions of Engines have you served,—jet condensing, surface condensing, or non-condensing engines, compounds, triples, inverted cylinders, or horizontal engines? What size were the engines?
- e. With what descriptions of boilers have you served,—Lancashire, marine, multitubular, sectional or locotype boilers?
- f. What engine defects have come under your notice, what caused these defects, and how were they remedied? Give the names of the factory for verification.
- g. What boiler defects have come under your notice, what caused these defects, and how were they remedied? Give the names of the factory for verification.

Notn. No. 5605, dated 22nd December 1896, B. G. G., 1896, Pt. I, p. 1334.—His Excellency the Governor in Council is pleased to vary, with effect from the 4th January 1897, the rules framed under Section 35 of the Bombay Boiler Inspection Act, 1891, and published in Government Notification No. 515, dated the 3rd February 1896⁽¹⁾, at pages 94 to 102 of the *Bombay Government Gazette* for 1896, Part I, by substituting for clause (d) of Rule 2 of the said rules the following clause :—

"(d) The words defined in Section 3 shall be deemed to have respectively the same meaning as is given to them by the Act, provided that wherever in these rules service with engines and boilers is required as a qualification for admission to an examination under Section 21, the word 'engine' or 'boiler' shall be held to include any locomotive engine or boiler used upon, or appertaining to, any railway within the meaning of that word as defined in Section 3, clause (4), of the Indian Railways Act, 1890."

Notn. No. 1503, dated 30th March 1896, B. G. G., 1896, Pt. I, p. 336.—Corrigendum.—In the second line of Rule 6 of the Rules published under Government Notification No. 515, dated 3rd February 1896⁽¹⁾, at pages 94—102 of the *Bombay Government Gazette* of the 6th idem, Part I, between the words "50 rupees" and "for each meeting" insert the words "per diem."

Notn. No 4221, dated 25th September 1896, B. G. G., 1896, Pt. I, p. 1003.—His Excellency the Governor in Council is pleased to vary, with effect from the 1st October 1896, the rules framed under Section 35 of the Bombay Boiler Inspection Act, 1891, and published in Notification No. 515, dated the 3rd February 1896⁽¹⁾, at pages 94 to 102 of the *Bombay Government Gazette* for 1896, Part I, in the manner hereinafter appearing, that is to say,—

Capabilities of
holders of
certificates.

(1) by substituting for Rule 43² of the said rules the following amended

"48. Holders of certificates of the first class will be deemed to be capable, as first class engineers, of having charge of boilers attached to prime movers of any horse-power.

Holders of certificates of the second class will be deemed to be capable, as second class engineers, of having charge of boilers attached to prime movers not exceeding sixty horse-power nominal.

Holders of certificates of the third class will be deemed to be capable, as third class engineers, of having charge of boilers attached to prime movers not exceeding twenty horse-power nominal."

(2) by substituting for Appendix B to the said rules the following:

"APPENDIX B.

(See Rules 43 and 46.)

Form of Certificate of Competency.

*Certificate of Competency of the Class granted under the Bombay
Boiler Inspection Act, 1891.*

No. of 189 .

A.B., aged about , at present residing at , having satisfied the Board of Examiners appointed under the Bombay Boiler Inspection Act, 1891, of his competency to have charge of a boiler attached to prime movers of any horse-power (or not exceeding 60 or 20 horse-power

(1) Printed at page 735, *supra*.

nominal, *as the case may be*), is granted under Section 21 (or 22 *as the case may be*) of the said Act this Certificate of Competency of the First (or Second or Third, *as the case may be*) Class.

The of 189 .

(Signed)

} Board of Examiners.

Duplicate of this Certificate has been recorded in the Steam Boiler office,
this day of 189 .

(Signed)

Collector of

Form of Certificate of Service.

*Certificate of Service of the Class granted under the Bombay Boiler
Inspection Act, 1891.*

No. of 189 .

A. B., aged about , at present residing at , having satisfied the Board of Examiners appointed under the Bombay Boiler Inspection Act, 1891, at , that he has served for a period of not less than three years prior to the 18th January 1892 (the date on which the said Act came into force) as Engineer in actual charge and management of a boiler, and that he is possessed of competent skill for the charge of a boiler attached to prime movers of any horse-power (or not exceeding 60 or 20 horse-power nominal, *as the case may be*), is granted under Section 23 of the said Act this Certificate of Service of the First (or Second or Third, *as the case may be*) Class.

The of 189 .

(Signed)

} Board of Examiners.

Duplicate of this Certificate has been recorded in the Steam Boiler Inspection office.

Collector.

Form of Certificate to be granted under Section 22 of the Act.

Whereas Mr. , at present residing at , has produced before us a Certificate of the class issued to him by the , we, in accordance with the provisions of the Bombay Boiler Act of 1891, Section 22, hereby authorize him to be in charge of boilers attached to prime movers of horse-power on the production of this Certificate.

*Rules relating to the duties of Inspectors with respect to the Inspection of
Steam Boilers.*

Notn. No. 1877A, dated 21st May 1894, B. G. G., 1894, Pt. I, p. 459.
In exercise of the power conferred by Section 35 (a) of the Bombay Boiler

Inspection Act, 1891, the Governor in Council is pleased to frame the following rules for settling the duties of Inspectors under the said Act with respect to the inspection of Steam Boilers in every part of the Bombay Presidency in which the said Act is in force, including Aden, *viz* :—

Iron Boilers.

1. The Inspector is required by the Act to fix the pressure to be allowed on boilers. In performing this very responsible and onerous duty he must be very careful, as in the event of accident it will be necessary for him to prove clearly that he used due caution. On the one hand he must be careful as regards safety, and on the other hand he must not unduly reduce the pressure on a boiler.

2. The Inspector should fix the working pressure for boilers by a series of calculations of the strength of the various parts, and according to the workmanship and material.

In the case of boilers made in India, the Boiler Inspection Department may receive for examination plans and particulars of boilers before the commencement of manufacture, by these means hoping to prevent questions arising after the boilers are finished. The Senior Inspector should receive and report on any plans of boilers intended for use in Bombay or the districts that may be submitted in due course.

When the Inspector has received plans and tracings of new boilers, or of alterations of boilers, and has approved of them, he will of course be careful in making his examination, when the boiler is ready for work, to see that they have been followed out. When he has not had the plans submitted, but is called in to inspect a boiler, he will of course measure the parts, note the details of construction, and, if necessary, bore the plates to ascertain their thickness, &c., before he gives his certificate.

No Inspector shall declare a boiler to be safe unless (a) he is fully informed as to its construction, material and workmanship, or unless (b) he is furnished with a certificate from a Chief Engineer of a recognised Boiler Insurance Company. He should therefore be very careful how he ventures to give a certificate.

3. In the case of new boilers the Inspector may allow a stress not exceeding 7,000 lbs. per square inch of net section on solid iron screwed stays supporting flat surfaces, but the stress should not exceed 5,000 lbs. when the stays have been welded or worked in the fire.

The areas of diagonal stays are found in the following way: Find the area of a direct stay needed to support the surface, multiply this area by the length of the diagonal stay, and divide the product by the length of a line drawn at right angles to the surface supported to the end of the diagonal stay; the quotient will be the area of the diagonal stay required.

When gusset stays are used, their area should be in excess of that found in the above way.

4. When the tops of combustion boxes or other parts of a boiler are supported by solid rectangular girders the following formula should be used for finding the working pressure to be allowed on the girders, assuming that they are not subjected to a greater temperature than the ordinary heat of steam,

and in the case of combustion chambers that the ends are fitted to the edges of the tube plate and the back plate of the combustion box.

$$\frac{C \times d^2 \times T}{(W - P) D \times L} = \text{Working Pressure.}$$

W = Width of combustion box in inches.

P = Pitch of supporting bolts in inches.

D = Distance between the girders from centre to centre in inches.

L = Length of girder in feet.

d = Depth of girder in inches.

T = Thickness of girder in inches.

C = 500 when the girder is fitted with one supporting bolt.

C = 750 when the girder is fitted with two or three supporting bolts.

C = 850 when the girder is fitted with four supporting bolts.

The working pressure for the supporting bolts and for the plate between them should be determined by the rule for ordinary stays.

5. The pressure on plates forming flat surfaces is found by the following formula:

$$\frac{C \times (T + 1)^2}{S - 6} = \text{Working Pressure.}$$

T = Thickness of the plate in sixteenths of an inch.

S = Surface supported in square inches.

C = Constant according to the following circumstances.

C = 100 when the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts and washers, the latter being at least three times the diameter of the stay and two-thirds the thickness of the plates they cover.*

C = 90 when the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts only.

C = 60 when the plates are exposed to the impact of heat or flame, and steam in contact with the plates, and the stays fitted with nuts and washers, the latter being at least three times the diameter of the stay and two-thirds the thickness of the plates they cover.

C = 54 when the plates are exposed to the impact of heat or flame, and steam in contact with the plates, and the stays fitted with nuts only.

C = 80 when the plates are exposed to the impact of heat or flame, with water in contact with the plates, and the stays screwed into the plates and fitted with nuts.

C = 60 when the plates are exposed to the impact of heat or flame, with water in contact with the plates, and the stays screwed into the plates, having the ends riveted over to form substantial heads.

C = 36 when the plates are exposed to the impact of heat or flame, and steam in contact with the plates, with the stays screwed into the plates, and having the ends riveted over to form substantial heads.

* If the diameter of riveted washers be at least 3rds the pitch of the stays, and the thickness not less than the plates they cover, the constant may be increased to 160.

When doubling plates are fitted of the same thickness as the plates they cover and not less in width than 3rds the pitch of the stays, the constant may be increased to 160.

In cases where plates are stiffened by T or L irons, and a greater pressure is required for the plates than is allowed by the use of the above constants, the case should be submitted for the consideration of the Senior Inspector.

When the riveted ends of screwed stays are much worn or when the nuts are burned, the constants should be reduced, but the Inspector must act according to the circumstances that present themselves at the time of inspection, and it is expected that in cases where the riveted ends of screwed stays in the combustion boxes and furnaces are found in this state, it will be often necessary to reduce the constant 60 to about 36.

The Inspector should not in any case allow a greater compressive stress on the edge of the tube plates than 7,500 lbs. per square inch, which is that used in the following formula:

$$\frac{(D-d) T \times 15,000}{W \times D} = \text{Working Pressure.}$$

$W \times D$

D = Least horizontal distance between centres of tubes in inches.

d = Inside diameter of ordinary tubes in inches.

T = Thickness of tube plate in inches.

W = Extreme width of combustion box in inches from front of tube plate to back of fire-box, or distance between combustion box tube plates when boiler is double ended and the box common to the furnaces at both ends.

6. Having regard to many cases in which serious defects have been discovered, the Inspector should take care that boilers, the outside of which cannot be seen, are cleared of all covering and fittings for inspection whenever the Inspector considers it necessary. It will often be found necessary to reduce the pressure, unless the boilers are partially cleared from their seats to enable the Inspector to judge of their condition. If the owners in any special case have any good reasons for not wishing to clear them when the Inspector requires it, the Inspector should submit the whole case in detail to the Senior Inspector for his consideration. The Inspector must recollect that he is not to certify as sufficient any boiler respecting which he cannot thoroughly satisfy himself.

The Inspector should record in his inspection book the dates on which boilers are inspected, when and to what extent cleared from brickwork, and whether the boilers were set or not when examined, and if not set, where they were examined. Boilers which have been cleared should in all cases be subjected to the hydraulic test before the brickwork is rebuilt.

7. Boilers well constructed, well designed, and made of good material should have an advantage in the matter of working pressure over boilers inferior in any of the above respects, as unless this is done the superior boiler is placed at a disadvantage, and good workmanship and material will be discouraged. The following rules are therefore prescribed.

When cylindrical boilers are made of the best material with all the rivet holes drilled in place and all the seams fitted with double butt straps each of at least five-eighths the thickness of the plates they cover, and all the seams at least double riveted with rivets having an allowance of not more than 75 per cent over the single shear and provided that the boilers have been open to inspection during the whole period of construction, then 5 may be used as the factor of safety. The tensile strength of the iron is to be taken as equal to 47,000 lbs. per square inch with the grain, and 40,000 lbs. across the grain.

But when the above conditions are not complied with, the additions in the following scale must be added to the factor 5, according to the circumstances of each case :

- | | | |
|----|-----|---|
| A† | ·15 | To be added when all the holes are fair and good in the longitudinal seams, but drilled out of place after bending. |
| B† | ·3 | To be added when all the holes are fair and good in the longitudinal seams, but drilled out of place before bending. |
| C | ·3 | To be added when all the holes are fair and good in the longitudinal seams, but punched after bending instead of drilled. |
| D | ·5 | To be added when all the holes are fair and good in the longitudinal seams, but punched before bending. |
| E* | ·75 | To be added when all the holes are not fair and good in the longitudinal seams. |
| F | ·1 | To be added if the holes are all fair and good in the circumferential seams, but drilled out of place after bending. |
| G† | ·15 | To be added if the holes are fair and good in the circumferential seams, but drilled before bending. |
| H | ·15 | To be added if the holes are fair and good in the circumferential seams, but punched after bending. |
| I† | ·2 | To be added if the holes are fair and good in the circumferential seams, but punched before bending. |
| J* | ·2 | To be added if the holes are not fair and good in the circumferential seams. |
| K | ·2 | To be added if double butt straps are not fitted to the longitudinal seams, and the said seams are lap and double riveted. |
| L | ·1 | To be added if double butt straps are not fitted to the longitudinal seams, and the said seams are lap and treble riveted. |
| M | ·3 | To be added if only single butt straps are fitted to the longitudinal seams, and the said seams are double riveted. |
| N | ·15 | To be added if only single butt straps are fitted to the longitudinal seams, and the said seams are treble riveted. |
| O | ·1 | To be added when any description of joint in the longitudinal seams is single riveted. |
| P. | ·1 | To be added if the circumferential seams are fitted with single butt straps and are double riveted. |
| Q | ·2 | To be added if the circumferential seams are fitted with single butt straps and are single riveted. |
| R | ·1 | To be added if the circumferential seams are fitted with double butt straps and are single riveted. |
| S | ·1 | To be added if the circumferential seams are lap joints and are double riveted. |
| T | ·2 | To be added if the circumferential seams are lap joints and are single riveted. |
| U | ·25 | To be added when the circumferential seams are lap, and the stakes of plates are not entirely under or over. |
| V† | ·3 | To be added when the boiler is of such a length as to fire from both ends, or is of unusual length, as in the case of flue boilers; and the circumferential seams fitted as described opposite P, R, and S, but of course when the circumferential seams are as described opposite O and T. V 2 |

W* 4 To be added if the seams are not properly crossed.

X* 4 To be added when the iron is in any way doubtful, and the Inspector is not satisfied that it is of the best quality.

Y†† 1.65 To be added if no certificate is produced from a Chief Engineer of a recognised Boiler Insurance Company or if the boiler was not open to inspection during the whole period of its construction by the Inspectors of any recognized Boiler Insurance Company.

Where marked* the factor of safety should be increased still further if the workmanship or material is very doubtful or is very unsatisfactory.

† When the holes are to be rimmed, or bored out in place, the case should be submitted to the Senior Inspector as to the reduction or omission of A, B, G, and I as heretofore.

‡ When boilers are comparatively short, the cases should be submitted to the Senior Inspector for consideration as to the omission of V as heretofore.

When the circumferential seams are double strapped and double riveted or lapped and treble riveted, and the calculated strength not less than 65 per cent. of the solid plate V, 3 may be omitted as heretofore.

The strength of ordinary joints is found by the following method:

$$\frac{(\text{Pitch} - \text{Diameter of rivet}) \times 100}{\text{Pitch}} = \left\{ \begin{array}{l} \text{Percentage of strength of plate at joint as compared with the solid plate.} \end{array} \right.$$

$$\frac{(\text{Area of rivet} \times \text{No. of rows of rivets}) \times 100}{\text{Pitch} \times \text{thickness of plate}} = \left\{ \begin{array}{l} \text{Percentage of strength of rivets as compared with the solid plate.} \end{array} \right.$$

Then take iron as equal to 47,000 lbs. per square inch and use the smaller of the two percentages as the strength of the joint, and adopt the factor of safety as found from the preceding scale.

$$\frac{(47,000 \times \text{percentage of strength of joint}) \times \text{twice the thickness of the plate in inches.}}{\text{Inside diameter of the boiler in inches} \times \text{factor of safety}} =$$

Pressure to be allowed per square inch on the safety-valves.

In the case of ordinary zigzag riveting the strength through the plate diagonally between the rivets, when diagonal pitch = $\frac{6}{10}$ horizontal pitch + $\frac{4}{10}$ diameter of rivet.

Plates that are drilled in place must have been taken apart and the burr taken off and the holes slightly countersunk from the outsides.

Butt straps must have been cut from plates and not from bars, and must be of as good a quality as the shell plates, and for the longitudinal seams must be cut across the fibre. The rivet holes may have been punched or drilled when the plates are punched or drilled out of place, but when drilled in place must have been taken apart and the burr taken off and slightly countersunk from the outside.

When single butt straps are used and the rivet holes in them punched, they must be one-eighth thicker than the plates they cover.

The diameter of the rivets must not be less than the thickness of the plates of which the shell is made, but it will be found when the plates are thin, or

§ If the rivets are exposed to double shear, multiply the percentage as found by 1.75.

when lap joints or single butt straps are adopted, that the diameter of the rivets should be in excess of the thickness of the plates.

Dished ends must be stayed as flat surfaces; but when they are theoretically equal to the pressure needed, when considered as portions of spheres, the stays when solid may have a stress of 14,000 lbs. per square inch of net section, but the stress should not exceed 10,000 lbs. when the stays have been welded or worked in the fire.

Truly hemispherical ends subjected to internal pressure may be allowed double the pressure that is suitable for a cylinder of the same diameter and thickness.

All man-holes and openings must be stiffened with compensating rings of at least the same effective sectional area as the plates cut out, and in no case should the plate rings be less in thickness than the plates to which they are attached. The openings in the shells of cylindrical boilers should have their shorter axes placed longitudinally. It is very desirable that the compensating rings round openings in flat surfaces be made of L or T iron. Cast-iron doors are not to be passed.

The neutral part of boiler shells under steam domes must be efficiently stiffened and stayed, as serious accidents have arisen from the want of such precautions.

8. New boilers are to be tested by hydraulic pressure according to the following scale.

Boilers intended to work up to 100 lbs. pressure per square inch or, any pressure below that are to be tested to double the working pressure.

Above lbs.		100 up to lbs.		125 to be tested to lbs.	
	125	"	150	"	230.
"	150	"	175	"	250.
"	175	"	200	"	270.
"	200	"	225	"	290.
"	225	"	250	"	310.
"	250	"	275	"	330.
"	275	"	300	"	350.

Any boilers intended for working pressure above these to be tested to not less than 50 lbs. above such working pressure.

In the case of old boilers the Inspector must use his own judgment as to the necessary pressure to be applied.

9. Circular furnaces with the longitudinal joints welded or made with a butt strap.

$$\frac{90,000 \times \text{the square of the thickness of the plate in inches}}{(\text{Length in feet} + 1) \times \text{diameter in inches}}$$

= working pressure per square inch, provided it does not exceed that found by the following formula:

$$\frac{8,000 \times \text{thickness in inches}}{\text{diameter in inches}} = \text{Working pressure per square inch.}$$

The second formula limits the crushing stress on the material to 4,000 lbs. per square inch.

The length is to be measured between the rings if the furnace is made with rings.

If the longitudinal joints instead of being butted are lap-jointed in the ordinary way, then 75,000 is to be used instead of 90,000, excepting only where the lap is bevelled and so made as to give the flues the form of a *true* circle, when 80,000 may be used.

When the material or the workmanship is not of the best quality, the constants given above must be reduced, that is to say, the 90,000 will become 80,000, the 80,000 will become 70,000, the 70,000 will become 60,000; when neither the material nor the workmanship is of the best quality, such constants will require to be further reduced, according to circumstances and the judgment of the Inspector, as in the case of old boilers. One of the conditions of best workmanship is that the joints are double riveted with double butt straps, or single riveted with double butt straps, and the holes drilled after the bending is done and when in place and the plates afterwards taken apart, the burr on the holes taken off and the holes slightly countersunk from the outside.*

The working pressure for corrugated furnaces, practically circular and machine made, provided the plane parts at the ends do not exceed 6 inches in length, and the plates are not less than $\frac{5}{16}$ inch thick, should not be greater than found by the following formula:

$$\frac{9,000 \times \text{thickness in inches}}{\text{Mean diameter in inches}} = \left. \vphantom{\frac{9,000 \times \text{thickness in inches}}{\text{Mean diameter in inches}}} \right\} \text{Working pressure per square inch.}$$

Steel Boilers.

10. For Steel Boilers the rules for iron boilers may be increased as follows:—

The constants for flat surfaces when they are supported by stays screwed into the plate and riveted, 10 per cent. The constants for flat surfaces when they are supported by stays screwed into the plate and nutted, or when the stays are nutted in the steam space, 25 per cent. This is also applicable to the

* The following examples will serve to show the application of the constants for the different cases that may arise:—

Furnaces with butt joints and drilled rivet holes.	{	90,000 where the longitudinal seams are welded.
		90,000 where the longitudinal seams are double riveted and fitted with single butt straps.
		80,000 where the longitudinal seams are single riveted and fitted with single butt straps.
		90,000 where the longitudinal seams are single riveted and fitted with double butt straps.
Furnaces with butt joints and punched rivet holes.	{	85,000 where the longitudinal seams are double riveted and fitted with single butt straps.
		75,000 where the longitudinal seams are single riveted and fitted with single butt straps.
		85,000 where the longitudinal seams are single riveted and fitted with double butt straps.
Furnaces with lapped joints and drilled rivet holes.	{	80,000 where the longitudinal seams are double riveted and bevelled.
		70,000 where the longitudinal seams are double riveted and not bevelled.
		70,000 where the longitudinal seams are single riveted and bevelled.
		65,000 where the longitudinal seams are single riveted and not bevelled.
Furnaces with lapped joints and punched rivet holes.	{	75,000 where the longitudinal seams are double riveted and bevelled.
		70,000 where the longitudinal seams are double riveted and not bevelled.
		65,000 where the longitudinal seams are single riveted and bevelled.
		60,000 where the longitudinal seams are single riveted and not bevelled.

In the case of upright fire-boxes of donkey or similar boilers, 10 per cent. should be deducted from the constants given above, applicable to the respective classes of work.

constants for flat surfaces stiffened by riveted washers or doubling strips, and supported by nutted stays.

The constants for combustion box girders, 10 per cent.

Boilers—General.

11. Small boilers must be surveyed and be fitted the same way as the main boilers, and have a water and steam gauge, and all other fittings complete, and as regards safety valves, must comply with the same regulations as the main boilers.

12. No boilers or steam chamber is to be so constructed, fitted, or arranged so that the escape of steam from it through the safety-valve can be wholly, or partially, intercepted by the action of any other valve.

A stop valve must always be fitted between the boiler and the steam pipe, and, where two or more boilers are connected with a steam receiver or superheater, between each boiler and the superheater or steam receiver. The object of this is obvious, viz., to avoid the failure of all the boilers through the failure of one. The necks of stop valves should be as short as practicable.

13. Each boiler must be fitted with a glass water-gauge, at least two test cocks, and steamgauge, that is to say, each boiler must be fitted with all fittings as complete as if there were only one boiler. When a factory has more than one boiler, and these boilers are fitted with stop-valves, each boiler must be treated as a separate one, and have all the requisite fittings.

14. On every inspection of a steam boiler the Inspector shall, if the boiler is large enough, go inside it, and make a thorough examination of it.

When the boilers are not large enough for the Inspector to get into, he should see them tested by hydraulic pressure at every annual inspection at least. The hydraulic test should also be applied at every inspection if the Inspector consider it necessary.

Whenever it is only removable stays that prevent getting in, he must order their removal, and he must see them properly replaced before granting his declaration.

If any part of a main boiler near the uptake fire-boxes or furnaces is so constructed that the Inspector cannot examine it, he is not to give a declaration, but shall report the case to the Senior Inspector.

If for special reasons, and for special reasons only, the Inspector cannot go inside a small boiler, he must distinctly state on the face of his declaration his reasons for not being able to do so.

15. If the boiler is too hot for the Inspector to examine the inside efficiently, and with safety and convenience, he should decline to examine the boiler, and absolutely refuse to grant a certificate, until he can make an efficient internal examination.

16. Before testing a boiler the Inspector shall examine it, take the necessary measurements, and calculate what the working pressure should be in accordance with the regulations, and only test it with reference to that pressure in accordance with Rule 8. If the test is not satisfactory, the pressure must be proportionately reduced.

This course will enable any necessary alterations to be made by the owners and prevent delay or disappointment. The Inspector who grants the certificate should not increase the working pressure without first consulting the Senior Inspector.

The Inspector who grants the certificate must examine the boilers thoroughly, and in the absence of special instructions from the Senior Inspector, will be held responsible for the pressure allowed.

17. The Inspector shall see all new boilers, and boilers that have been cleaned for a thorough repair, tested by hydraulic pressure, in accordance with Rule 8 previous to the boilers being set, and before they are covered in, to test the workmanship, &c.; but the working pressure is to be determined by the strength of stays, thickness of plates, and strength of riveting, &c., and not by the hydraulic test.

The hydraulic test should in no case exceed twice the calculated working pressure of the boiler, and it is never to be applied until the boiler has been examined and until the strength has been calculated, from the necessary measurements taken from the boiler itself.

When the boilers are set the Inspector may, at any time he thinks it necessary, before he gives a certificate, have them tested by hydraulic pressure to satisfy himself as to any doubtful part, or of places not easy of access, care being taken in the case of old boilers not to overstrain them; but the test must always exceed the working pressure.

The hydraulic test should, before a certificate is granted, be applied to all boilers that have not previously had a working certificate.

When a boiler is partially inspected by one Inspector, and the inspection is completed and a certificate granted by another, if the Inspector who witnesses the test of the boiler by hydraulic pressure has an opportunity of examining it inside and outside after the test, such Inspector should determine the pressure to be allowed on the boiler in question, taking care to inform the makers, owners, or agents, and the Inspector who is ultimately to grant a certificate, what pressure should in his opinion be allowed on it. In the event of the original Inspectors having no opportunity to examine the boiler inside and out after the hydrostatic test, the Inspector must re-test the boiler by water and examine the boiler inside and out before determining the working pressure and granting a certificate.

The amount of the hydraulic pressure test, and the date on which it was last applied to the boiler, should be inserted in the Inspector's certificate, and recorded in the dimension sheet of that boiler.

Inspectors should pay particular attention to the examination and testing of steam pipes and economisers.

In all cases in which a socket expansion joint is fitted to a bent steam pipe, the Inspector should require a fixed gland and bolts to be fitted, in order to prevent the end of the pipe being forced out of the socket. This regulation should be complied with in all cases of bent pipes fitted with socket expansion joints. Fixed glands and bolts should be fitted to the expansion joints of straight steam pipes, as cases have occurred, particularly with small straight pipes, in which the ends of the pipes have been forced out of the sockets.

18. In all boilers in which the Inspectors find that cast iron is employed in such a manner as to be subject to the pressure of steam or water, they shall report the circumstances to the Senior Inspector, in order that they may receive instructions how to act. Cast iron must not be used for stays, and Inspectors should discourage the use of cast iron saddles for boilers.

19. A pressure once allowed on a boiler is not, *under any circumstances whatever*, to be increased unless the Inspector has previously written for and obtained the sanction of the Senior Inspector.

In case an Inspector is of opinion that an increased pressure may with safety be allowed, he shall communicate with the Inspector who last inspected the boiler; and if on learning the reasons why the existing pressure was formerly allowed, the Inspector is still of opinion that it may be increased, he should communicate all the facts of the case to the Senior Inspector; but, as above stated, the pressure shall not in any case be increased until the question has been decided by him.

Safety-valves.

20. The Inspectors are instructed that in all *new boilers*, and whenever *alterations can be easily made*, the safety-valve and stop-valve should be placed directly on the boiler; and the neck, or part between the valve and the flange which is bolted on to the boiler, should be as short as possible.

The Inspector should note that it is not intended by this instruction that old boilers which have been previously passed with such an arrangement should be thrown out of work for the alterations to be carried out.

Of course in any case in which an Inspector is of opinion that it is positively dangerous to have a length of pipe between the boilers and the safety-valve, it is his duty at once to insist on the requisite alterations being made before granting a declaration.

The Inspector shall declare, amongst other things, the limits of the weight to be placed on the safety-valves, and that the safety-valves are such and in such condition as required by the Act.

21. The area per square foot of fire grate surface of safety-valves, or (when there is more than one safety-valve on the boiler) the combined area of the safety-valves should be not less than that given in the following tables opposite the boiler pressure intended, provided the valves are not less than two inches in diameter. This applies to new boilers which have not received a working certificate.

In ascertaining the fire grate area, the length of the grate should be measured from the inner edge of the dead plate to the front of the bridge, and the width from side to side of the furnace on the top of the bars at the middle of their length.

If there is only one safety-valve on a *main* boiler the Inspector should not grant a certificate without first referring the case to the Senior Inspector for special instructions.

In the case of small boilers, if it is wished to fit valves smaller than two inches diameter, the case should be submitted for the consideration of the Senior Inspector.

SAFETY-VALVE AREAS.

Boiler Pressure.	Area of Valve per square foot of Fire grate.	Boiler Pressure.	Area of Valve per square foot of Fire grate.	Boiler Pressure.	Area of Valve per square foot of Fire grate.	Boiler Pressure.	Area of Valve per square foot of Fire grate.	Boiler Pressure.	Area of Valve per square foot of Fire grate.
lbs.	Sq. inch.	lbs.	Sq. inch.	lbs.	Sq. inch.	lbs.	Sq. inch.	lbs.	Sq. inch.
15	1.250	53	.551	90	.357	127	.264	164	.209
16	1.209	54	.543	91	.353	128	.262	165	.208
17	1.171	55	.535	92	.350	129	.260	166	.207
18	1.136	56	.528	93	.347	130	.258	167	.206
19	1.102	57	.520	94	.344	131	.256	168	.204
20	1.071	58	.513	95	.340	132	.255	169	.203
21	1.041	59	.506	96	.337	133	.253	170	.202
22	1.013	60	.500	97	.334	134	.251	171	.201
23	.986	61	.493	98	.331	135	.250	172	.200
24	.961	62	.487	99	.328	136	.248	173	.199
25	.937	63	.480	100	.326	137	.246	174	.198
26	.914	64	.474	101	.323	138	.245	175	.197
27	.892	65	.468	102	.320	139	.243	176	.196
28	.872	66	.462	103	.317	140	.241	177	.195
29	.852	67	.457	104	.315	141	.240	178	.194
30	.833	68	.451	105	.312	142	.238	179	.193
31	.815	69	.446	106	.309	143	.237	180	.192
32	.797	70	.441	107	.307	144	.235	181	.191
33	.781	71	.436	108	.304	145	.234	182	.190
34	.765	72	.431	109	.302	146	.232	183	.189
35	.750	73	.426	110	.300	147	.231	184	.188
36	.735	74	.421	111	.297	148	.230	185	.187
37	.721	75	.416	112	.295	149	.228	186	.186
38	.707	76	.412	113	.292	150	.227	187	.185
39	.694	77	.407	114	.290	151	.225	188	.184
40	.681	78	.403	115	.288	152	.224	189	.183
41	.669	79	.398	116	.286	153	.223	190	.182
42	.657	80	.394	117	.284	154	.221	191	.181
43	.646	81	.390	118	.281	155	.220	192	.181
44	.635	82	.386	119	.279	156	.219	193	.180
45	.625	83	.382	120	.277	157	.218	194	.179
46	.614	84	.378	121	.275	158	.216	195	.178
47	.604	85	.375	122	.273	159	.215	196	.177
48	.596	86	.371	123	.271	160	.214	197	.176
49	.585	87	.367	124	.269	161	.213	198	.176
50	.576	88	.364	125	.267	162	.211	199	.175
51	.568	89	.360	126	.265	163	.210	200	.174
52	.559								

22. The Inspector in his examination of the boilers and appurtenances is particularly to direct his attention to the safety-valves, and whenever he considers it necessary, he is to satisfy himself as to the pressure on the boiler by actual trial.

The Inspector is to fix the limits of the weight to be placed on the safety-valves, and the responsibility of issuing a certificate before he is fully satisfied on the point is very grave. The law places on the Inspector the responsibility of "declaring" that the boilers are in his judgment sufficient with the weights he states. The Inspector is to examine the whole of the valves, weights, and springs at every inspection.

The responsibility of seeing to the efficiency of the mode by which the valves are fitted so as to be as much as practicable under the control of the engineer when steam is up, rests with the Inspector.

The safety-valve should be fitted with lifting gear, which should in all cases be arranged so that it can be worked by hand.

Care should be taken that the safety-valves have a lift equal to at least one-fourth their diameter; that the openings for the passage of steam to and from the valves, including the waste steam pipe, should each have an area not less than the area of valves required, and that each valve-box has a drain pipe fitted at its lower part. In the case of lever valves, if the lever is not bushed with brass, the pins must be of brass; iron and iron working together must not be passed. Too much care cannot be devoted to seeing that there is proper lift, and free means of escape of waste steam, as it is obvious that unless the lift and means for escape of waste steam are ample, the effect is the same as reducing the area of the valve or putting on an extra load. The valve seats should be secured by studs and nuts.

The Inspectors are, as far as is in their power, to make these points generally known to the owners of Steam Boilers.

23. When the Inspector has determined the amount of pressure, he is to see the valves weighted accordingly and the weights or springs fixed in such a manner as to preclude the possibility of their shifting or in any way increasing the pressure. The limits of the weight on the valves is to be inserted in the declaration, and should it at any time come to an Inspector's knowledge that the weights or the loading of the valves have been shifted, or otherwise altered, or that the valves have been in any way interfered with, so as to increase the pressure, without the sanction of the Senior Inspector, he is at once to report the facts.

Notn., No. 3440, dated 5th August 1896, B. G. G., 1896, Pt. I, p. 833.—
The following rules framed under Section 35 (a) of the Bombay Boiler Inspection Act of 1891, as additions to the rules framed under the said section, for settling the duties of Inspectors appointed under the said Act, and published in the Notification mentioned in the margin*, are published for general information, that is to say,—

*No. 1877 A (1) at Bombay Government Gazette for 1894, Part I, pages 459-465.

Add to Rule 10 of the said Rules.

The constants for plain furnaces 10 per cent.

In cases where the Inspector is satisfied from tests made on the steel from which the boiler has been constructed that it is of a certain tensile strength per square inch, that strength may be substituted for the 47,000 lbs. (allowed for iron plates) in the formula given in Rule 7, but in no case is a greater strength than 32 tons (71,680 lbs.) to be allowed. In other cases, provided there is sufficient proof that the boiler is of steel, a minimum of 27 tons may be used.

Solid steel screwed stays which have not been welded or otherwise worked after heating may be allowed a working stress of 9,000 lbs. per square inch

of net section. Steel stays which have been welded or worked in the fire have been found to be unreliable, therefore they should not be passed.

Furnaces cor-
rugated or rib-
bed and groov-
ed.

When furnaces are machine made by Messrs. The Leeds Forge Company, of the Fox corrugated and Morison suspension types, or by Messrs. John Brown & Co., Sheffield, of the Purves ribbed and grooved type, if they are practically true circles, and the plates not less than $\frac{1}{16}$ inch thick, the working pressure is found by the following formula :

$$\frac{C \times T}{D} = \text{working pressure.}$$

$C = 14,000$ for Fox's corrugated and Brown's ribbed and grooved furnace.

$C = 13,500$ for Morison's suspension furnace.

T = thickness in inches.

D = outside diameter in inches, measured at the bottom of the corrugations when the furnace is of the corrugated or suspension type, or over the plain parts when it is of the ribbed and grooved description.

In Fox's corrugated furnaces the pitch of the corrugations and the length of the plain parts at the ends should not exceed 6 inches, and in Morison's suspension furnaces the pitch should not exceed 8 inches, and the length at the ends 5 inches. In both descriptions of furnaces the depth from top of corrugations outside to bottom of corrugations inside should not be less than 2 inches, and the plates at the ends should not be unduly thinned in the flanging.

The plates of ribbed and grooved furnaces should be formed by rolling, the ribs should not be less than $1\frac{1}{16}$ inches above the plain parts, and the depth of the grooves not more than $\frac{3}{4}$ inch, the length between the centres of the ribs not over 9 inches, and that of the plain parts at the ends not over 6 inches, and the ends rolled slightly thicker than the plain parts, and not reduced at any part by flanging, &c., below the thickness of the body of the furnace.

If the furnace is riveted in one or more lengths the case should be submitted for consideration.

Furnaces
made up of
flanged rings.

When horizontal furnaces of ordinary diameter are constructed of a series of rings welded longitudinally, and the ends of each ring flanged and the rings riveted together, and so forming the furnace, the working pressure is found by the following formula, provided the length in inches between the centres of the flanges of the rings is not greater than $(120 T - 12)$, and the flanging is performed at one heat by a suitable flanging machine, and also the conditions which follow the formula are complied with :

$$\frac{9900 \times T}{3 \times D} \left(5 - \frac{l + 12}{60 \times T} \right) = \text{working pressure.}$$

T = thickness of plate in inches.

l = length between centre of flanges in inches.

D = outside diameter of furnace in inches.

The radii of the flanges on the fire side should be about $1\frac{1}{2}$ inches. The depth of the flanges from the fire side should be three times the diameter of the rivet plus $1\frac{1}{2}$ inches, and the thickness of the flanges should be as near the thickness of the body of the plate as practicable. The distance from the edge of the rivet holes to the edge of the flange should not be less than the diameter of the rivet, and the diameter of the rivets at least $\frac{3}{8}$ inch greater than the thickness of the plate. The depth of the ring between the flanges should be not less than three times the diameter of the rivets, the fire edge of the ring should be about the termination of the curve of flange, and the thickness not less than half the thickness of the furnace plate. Turned rings are such as may be considered a first class method of construction.

The holes in the flanges and rings should be drilled in place if practicable, but if not drilled in place they should be drilled sufficiently small, and afterwards when in place rimmed out until the holes are quite fair; the holes should be slightly tapered and the heads of the rivets of moderate size.

After all welding, and after all flanging and heating each ring should be efficiently annealed in one operation.

A greater compressive stress should not be allowed on tube plates than 10,000 lbs., which is that used in the following formula :

Compressive stress on tube plates.

$$\frac{(D-d) T \times 20,000}{W \times D} = \text{working pressure.}$$

D=least horizontal distance between centres of tubes in inches.

d=inside diameter of ordinary tubes in inches.

T=thickness of tube plate in inches.

W=extreme width of combustion-box in inches from front of tube plate to back of fire-box, or distance between combustion-box tube plates when boiler is double-ended and the box common to the furnaces at both ends.

When full allowance is wished the rivet section, if iron, in the longitudinal seams of cylindrical shells should, when those seams are lapped, be at least $\frac{1}{8}$ times the net plate section, and if steel rivets are used their section should be at least $\frac{2}{3}$ of the net section of the plate, if the tensile stress of the rivets is not less than 27 tons and not more than 32 tons per square inch. In calculating the working pressure, the percentage strength of the rivets may be found in the usual way by the Board of Trade rules, but in the case of iron rivets the percentages found should be divided by $\frac{1}{8}$, and in the case of steel rivets by $\frac{2}{3}$, the results being the percentages required. If the percentage strength of the rivets by calculation is less than the calculated percentage strength of the plate, calculate the working pressure by both percentages. When using the percentage strength of the plate 4.5 plus the additions suitable for the method of construction as by the rules for iron boilers, may be used as the nominal factor of safety, but when using the percentage strength of the rivets 4.5 may be used as the factor of safety. The less of the two pressures so found is the working pressure to be allowed for the cylindrical portion of the shell, or otherwise in accordance with the formulæ in Appendix.

Plate and rivet section.

Add as an Appendix to the said rules.

APPENDIX.

(See last paragraph of Rule 10.)

CYLINDRICAL BOILER SHELLS.

JOINTS WITH DRILLED HOLES.

Formulae for ordinary chain riveted and ordinary zigzag riveted joints, and for joints of these descriptions, when every alternate rivet in the outer or in the outer and inner rows have been omitted :

- Let E = distance from edge of plate to centre of rivet in inches.
 V = distance between rows of rivets in inches.
 V^1 = distance between inner and middle row of rivets in inches
for joints J and K (Figs. 19 and 15.)
 B = boiler pressure in lbs. per square inch.
 C = .1 for lap or single butt joints.
 C = 1.75 for double butt joints.
 d = diameter of rivets in inches.
 D = inside diameter of boiler in inches.
 F = factor of safety for shell plates, as by clause 87 or clause
103.
 n = number of rivets in one pitch.
 p^n = diagonal pitch in inches.
 P^n = diagonal pitch in inches between inner and middle rows of
rivets in inches for joint J.
 p = greatest pitch of rivets in inches.
 r = percentage of plate left between holes in greatest pitch.
 R = percentage of rivet section.
 R^1 = percentage of combined plate and rivet section.
 S = tensile strength of material in lbs. per square inch of
section.
 T = thickness of plate in inches.
 T^1 = thickness of each butt strap in inches.
 $\%$ = least value of r, R, R^1 , as the case may be, divided by 100.

When joints are used in boiler construction other than those shown in the attached sketches, or when any of the rivets are pitched less than two diameters apart, the particulars of such joints should be submitted for the consideration of the Senior Inspector.

ORDINARY CHAIN AND ZIGZAG RIVETED JOINTS.

Iron plates and iron rivets or steel plates and steel rivets:

$$\frac{100(p-d)}{p} = r.$$

Iron plates and iron rivets:

$$\frac{100 \times d^2 \times .7854 \times n \times C}{p \times T} = R.$$

Steel plates and steel rivets:

$$\frac{100 \times 23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times p \times T} = R.$$

GIVEN C, d, F, n, T, TO FIND p, SO THAT r AND R ARE EQUAL.

Iron plates and iron rivets:

$$\frac{d^2 \times .7854 \times n \times C}{T} + d = p.$$

Steel plates and steel rivets:

$$\frac{23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times T} + d = p.$$

GIVEN C, F, n, T, r, TO FIND p AND d.

Iron plates and iron rivets:

$$\frac{r \times T}{(100 - r) \times .7854 \times n \times C} = d.$$

$$\frac{100 \times r \times T}{(100 - r)^2 \times .7854 \times n \times C} = p.$$

Steel plates and steel rivets:

$$\frac{4.5 \times 28 \times r \times T}{23 \times (100 - r) \times .7854 \times n \times C \times F} = d.$$

$$\frac{100 \times 4.5 \times 28 \times r \times T}{23 \times (100 - r)^2 \times .7854 \times n \times C \times F} = p.$$

Iron plates and iron rivets or steel plates and steel rivets, when d is found first, then:

$$\frac{100 d}{100 - r} = p.$$

BUTT STRAPS.

Iron plates and iron butt straps or steel plates and steel butt straps:

Double butt straps:

$$\frac{5 \times T}{8} = T^1$$

Single butt straps:

$$\frac{9 \times T}{8} = T^1.$$

FOR DISTANCE BETWEEN ROWS OF RIVETS, &c.

Iron and steel :

$$\frac{3 \times d}{2} = E.$$

Chain-riveted joints, Figs. 2, 4, 6, 9, 11, not less than :

$$2 \times d = V.$$

See note at the end.

Zigzag riveted joints, Figs. 3, 5, 7, 10, 12 :

$$\sqrt{\frac{(11p + 4d)(p + 4d)}{10}} = V.$$

Diagonal pitch, Figs. 3, 5, 7, 10, 12 :

$$\frac{6p + 4d}{10} = p^D.$$

TO DETERMINE THE WORKING PRESSURE

$$\frac{S. \times \% \times 2 T}{F \times D} = B$$

CHAIN AND ZIGZAG RIVETED JOINTS IN WHICH EVERY ALTERNATE RIVET HAS BEEN OMITTED IN THE OUTER ROW, OR IN THE OUTER AND THE INNER ROWS SUCH AS ARE SHOWN BY THE FOLLOWING SKETCHES.

Iron plates and iron rivets or steel plates and steel rivets :

$$\frac{100(p-d)}{p} = r.$$

Iron plates and iron rivets :

$$\frac{100 \times d^2 \times .7854 \times n \times C}{p \times T} = R.$$

Steel plates and steel rivets :

$$\frac{100 \times 23 \times d^2 \times .7854 \times n \times C \times F}{4.5 \times 28 \times p \times T} = R.$$

Iron plates and iron rivets or steel plates and steel rivets :

$$\frac{100(p-2d)}{p} + \frac{R}{n} = R^1.$$

BUTT STRAPS.

Where the number of rivets in the inner row is double the number in the outer row.

Iron plates and iron butt straps or steel plates and steel butt straps.

Double butt-straps :

$$\frac{5 \times T(p-d)}{8 \times (p-2d)} = T^1.$$

Single butt straps :

$$\frac{9 \times T (p-d)}{8 \times (p-2d)} = T^1.$$

When the number of rivets in the inner row is the same as in the outer row.

Double butt straps :

$$\frac{5 \times T}{8} = T^1.$$

Single butt straps :

$$\frac{9 \times T}{8} = T^1.$$

FOR DISTANCE BETWEEN ROWS OF RIVETS, &c.

Iron and steel :

$$\frac{3 \times d}{2} = E.$$

Chain riveted joints, Figs. 13, 14, 15, 16 :

$$\sqrt{\frac{(11p + 4d) \times (p + 4d)}{10}} = V. \quad \left. \begin{array}{l} \text{The greater of these} \\ \text{two values of V to} \\ \text{be used. See note} \\ \text{at the end.} \end{array} \right\}$$

or $2 \times d = V.$

For joint K. (Fig. 15) :

$$2 \times d = V^1. \quad \text{See note at the end.}$$

Zigzag riveted joints. Figs. 17, 18, 19, 20 :

$$\sqrt{\frac{(11p + d) (16p + d)}{10}} = V.$$

Diagonal pitch, Figs. 17, 18, 19, 20 :

$$\frac{11}{16}p + d = p^D.$$

For joint J (Fig. 19) :

$$\sqrt{\frac{(11p + 8d) (p + 8d)}{20}} = V^1.$$

Diagonal pitch (Fig. 19) :

$$\frac{3p + 4d}{10} = P^D.$$

TO DETERMINE THE WORKING PRESSURE.

$$\frac{S \times \% \times 2T}{F \times D} = B^1.$$

MAXIMUM PITCHES FOR RIVETED JOINTS. •

T = Thickness of plate in inches.

p = Maximum pitch of rivets in inches, provided it does not exceed 10 inches.

C = Constant applicable from the following table :

Number of Rivets in one Pitch.	Constants for Lap Joints.	Constants for Double Butt Strap Joints.
1	1.31	1.75
2	2.62	3.50
3	3.47	4.63
4	4.14	5.52
5	—	6.00

$$(C \times T) + 1\frac{1}{8} = p.$$

When the work is first class, such pitches may be adopted so far as safety is concerned, yet in some cases it may be well not to adopt the greatest pitch found by the formula. The maximum pitch should *not*, however, exceed 10 inches with the thickest plates for boiler shells. If in any case the pitch is found to exceed that arrived at by the foregoing formula, for the particular description of joint and thickness of plate, such pitches should *not* be passed, but in all cases reported.

NOTE.— The minimum value of V or $\sqrt{V}$ for chain riveted joints is given as $2d$, but $4d + 1$ is more desirable.

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